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May 20, 1998

National Aeronautics and Space Administration  
George C. Marshall Space Flight Center  
Marshall Space Flight Center, AL 35812

MHT-0095-98  
Mail Stop #25

Attention: Linda Jeter, MG21  
Contracting Officer Technical Representative

Subject: Contract NAS8-39879; Final Report on DAS Sustaining Engineering

Dear Ms. Jeter:

Teledyne Brown Engineering (TBE), a Division of Teledyne Industries, Inc., submits herewith the Final Report for NAS8-39879. This report is being submitted in accordance with Paragraph 17.A, Reports of Work/Monthly Progress Reports, of the subject contract.

Sincerely,

TELEDYNE BROWN ENGINEERING  
A DIVISION OF TELEDYNE INDUSTRIES, INC.

*Martha H. Teenor*  
Martha H. Teenor  
Senior Contract Administrator

MHT/sr

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Contract NAS8-39879  
Final Report on DAS Sustaining Engineering

General

The Data Acquisition System Contract was awarded to Teledyne Brown Engineering on 5/24/94. The original contract was for one (1) year with four (4), one-year options. Three (3) of the four (4) options have been exercised with the third option concluding on 5/24/98. This contract was a follow-on contract to the original DAS contract NAS8-36633, which was awarded to Teledyne Brown Engineering in August 1986.

Summary

The objective of the original contract was to develop an intelligent Data Acquisition System (DAS) to be used in the Advanced Automated Directional Solidification Furnace (AADSf) system. The requirements of the DAS were provided to TBE in the form of a preliminary Marshall Space Flight Center Specification, MSFC-SPEC-1268. The first effort was to review and assist in the completion of this specification. The review was completed and the task of designing, developing, fabricating, testing, and delivering the hardware was initiated.

Hardware deliverables were as follows:

- a. Two Ground DAS units
- b. Two Flight DAS units
- c. Logistic Spares (as defined by MSFC)
- d. Shipping Containers.

Ground Units

The two ground units were completed and delivered as follows:

1. Unit No. 1 was retained at TBE Engineering Laboratory where it has been used for AADSf Software Development throughout the life of the NAS8-36633 and NAS8-39879 contracts with Options 1, 2, and 3. This unit has served as a test bed in the resolution of both hardware and software problems for the AADSf system.
2. Unit No. 2 was delivered to MSFC Ground Control Experiment Laboratory (GCEL) where it has been used to support AADSf System Tests and for the Experiment Development by the Principal Investigators.

Flight Units

Two flight units were delivered to MSFC for use in the AADSf/USMP System Flights. One of these units has flown on each AADSf missions.

The two Flight units were:

<u>Part No.</u>	<u>Serial No.</u>	<u>Description</u>
F4-10183-1	03	Flight DAS Unit
F4-10183-1	04	Flight DAS Unit

Flight Unit (F4-10183-1) Serial Number 04 was used as a Proto-Flight Qualification Unit. Prior to its use in the first flight it was subjected to protoflight qualification vibration levels. It was later integrated into the AADSF system and subjected to Thermal Vacuum test as required by MSFC thermal group. This unit flew on the first AADSF mission.

#### Logistic Spares

One logistic spare unit for each of the Line Replaceable Unit in the Flight DAS was fabricated, tested, and stored in the Government Stockroom at TBE. Each item is listed below:

<u>Item No.</u>	<u>Part No.</u>	<u>Serial No.</u>	<u>Nomenclature</u>
1.	F4-40921-3	03	CPU Printed Wiring Assembly
2.	F4-40912-7	08	Memory, Printed Wiring Assembly
3.	F4-40912-11	11	Memory, Printed Wiring Assembly
4.	F4-40912-13	14	Memory, Printed Wiring Assembly
5.	F4-40964-3	12	Analog Input, Printed Wiring Assembly
6.	F4-40964-5	14	Analog Input, Printed Wiring Assembly
7.	F4-40964-7	15	Analog Input, Printed Wiring Assembly
8.	F4-40964-9	19	Analog Input, Printed Wiring Assembly
9.	F4-40930-3	05	Discrete Input/Discrete Output Printed Wiring Assembly
10.	F4-40930-5	08	Discrete Input/Discrete Output Printed Wiring Assembly
11.	F4-40951-3	03	Serial Input-Serial Output Printed Wiring Assembly
12.	F4-41041-1	04	SP86 Power Supply Assembly

The Logistic Spare Items represent one of each unique configuration in a Flight DAS system. These units have undergone acceptance level testing on an individual basis, and have been installed in a Flight DAS enclosure and subjected to Protoflight vibration levels at MSFC. All the printed wiring assemblies are flight worthy items. The Power Supply has passed all tests, but has been down graded to a "non-flight" status. Pursuant to MSFC Memo GP32D(98), these units and all residual DAS stock are being transferred to PMIC Contract NAS8-41000, awaiting further disposition from MSFC.

#### Shipping Containers

Three Shipping containers were designed and purchased from Zero Manufacturing Company. All three of these containers were refurbished in 1997. New foam was installed. The new foam will support DAS storage and shipments of the DAS units for at least ten years.

#### Data Requirements

Data Requirements commensurate with the requirements of the DAS program were delivered on the NAS8-36633 contract. They have been updated as required on the follow-on NAS8-39879 contract.

#### Scope of NAS8-39879

TBE has provided Management, Technical, and Administrative skills, labor, materials, facilities, and equipment necessary to maintain the operational integrity of the Flight and non-flight DAS units. These units have provided support to the AADSF/USMP Microgravity Program activities. System upgrades included the installation of Current Monitor Units in each of the Flight DAS

Units. Source Control Drawings (SCD) defining the required configuration of the monitor units for the DAS and the AADSF Signal Conditioner and Control System (SCCS) were developed by TBE. Procurement was initiated for the DAS units and, design modifications, installations, and testing were performed.

Sustaining engineering and maintenance activities related to DAS refurbishment, Recertification (Flight Reverification), and Integration activities support were provided.

TBE provided technical support in the evaluation of all AADSF/USMP system anomalies to help isolate the problem. TBE received the Flight DAS after each mission and performed visual inspections and annotated anomalies as required. Repair and/or refurbishment were performed when dictated, and the baseline configuration was maintained. Appropriate documentation identifying the refurbishment and/or repair and test requirements were generated. Proper tests validating refurbishment and/or repair were performed and documented. The Flight DAS was returned to MSFC for integration into the system ready for its next mission.

The initial configuration of the DAS was established in accordance with Marshall Manual 8040.12A. As-Designed and As-Built configurations have been maintained during the consummation of NAS8-39879.

During the performance of the contract, TBE has assisted MSFC in updating and maintaining the MSFC specification, MSFC 1268, current with the DAS program requirements.

TBE has continuously monitored GUIDEP Alerts. Each alert has been evaluated with respect to its impact on the DAS. Periodic Alert status reporting has been ongoing throughout the performance of the contract.

We have performed the analysis and testing necessary to keep current the Reflight Verification for each mission.

Waivers/deviations have been generated resulting from system and documentation reviews during the performance of the contract.